CLAIMS

1. An exposure method in which the image of the pattern of a mask is projected onto a substrate on a substrate stage via a projection optical system, characterized by comprising:

using a first focus position detection system which, by illuminating with a beam for detection, obliquely with respect to an optical axis of the projection optical system, a first set of a plurality of measurement points on a surface for detection, on an object plane side or on an image plane side of the projection optical system, individually detects focus positions which are positioned in the optical axis direction at the plurality of measurement points; and a second focus position detection system which, by illuminating with a beam for detection, obliquely with respect to the optical axis, a second set of a plurality of measurement points on the surface for detection, individually detects the focus positions at the plurality of measurement points; the first set of a plurality of measurement points and the second set of a plurality of measurement points having at least some measurement points substantially in common;

detecting focus positions at the common measurement points using the first and second focus position detection systems;

performing calibration of detection results of the first and second focus position detection systems based on the detection results; and,

focusing the image plane of the projection optical system on the surface of the substrate by using the detection results of at least one of the first and second focus position detection systems.

2. The exposure method according to claim 1, characterized in that the first and second focus position detection systems illuminate the vicinity of the common measurement points with beams for detection that vibrate in mutually different directions, and the reflected light of the beam for detection is detected.

3. The exposure method according to claim 1 or claim 2, characterized in that:

the method further uses a third focus position detection system which detects the focus state of the mask and the substrate, by detecting, via the projection optical system, at least one of a first mark on the mask and a second mark on the substrate stage;

when detecting the focus positions at the common measurement points using the first and second focus position detection systems, if a difference in the detection results reaches a prescribed state, the focus state between the mask and the substrate is detected by the third focus position detection system; and,

based on the detection results, calibration of the detection results of the first and second focus position detection systems is performed.

4. An exposure apparatus, having a projection optical system which projects an image of the pattern of a mask onto a substrate and a substrate stage which positions the substrate within a plane substantially perpendicular to the optical axis of the projection optical system, and characterized by further comprising:

a focusing stage, which drives at least either the mask and the substrate in the direction of the optical axis of the projection optical system;

a first focus position detection system which, by illuminating with a beam for detection, obliquely with respect to the optical axis of the projection optical system, a first set of a plurality of measurement points on a surface for detection on an object plane side or on an image plane side of the projection optical system, individually detects focus positions which are positioned in the optical axis direction at the plurality of measurement points; and

a second focus position detection system which, by illuminating with a beam for detection, obliquely with respect to the optical axis, a second set of a plurality of measurement points on the surface for detection, at least some of which are substantially in common with the first set

of plurality of measurement points, individually detects the focus positions at the plurality of measurement points;

wherein the focusing stage is driven, based on detection results of at least one of the first and second focus position detection systems, to focus the image plane of the projection optical system on the surface of the substrate.

5. The exposure apparatus according to claim 4, characterized by further comprising:

a third focus position detection system which detects a focus state of the mask and the substrate, by detecting at least one of a first mark on the mask and a second mark on the substrate stage via the projection optical system; and

a control system which, based on the detection results of the third focus position detection system, performs calibration of the detection results of the first and second focus position detection systems.

6. The exposure apparatus according to claim 5, characterized in that the first and second focus position detection systems comprise:

light-transmission systems to illuminate the vicinity of the common measurement points with beams for detection which vibrate in mutually different directions;

light-receiving systems which receive reflected light of the beams for detection; and

detection systems which synchronously detect the detection signals from the light-receiving systems, in sync with the vibration of the beams for detection.

7. An exposure method, using an exposure light source which generates an exposure beam and an exposure main unit which holds a mask and a substrate, and in which the exposure beam is used to transfer a pattern of the mask onto the substrate, the exposure method being characterized in that:

a first illumination system which transmits the exposure beam from the exposure light source is supported independently of the exposure main unit;

a second illumination system which guides the exposure beam from the first illumination system to the exposure main unit is fixed to the exposure main unit; and,

the optical paths of the exposure beam within the first illumination system and within the second illumination system are each substantially sealed.

8. The exposure method according to claim 7, characterized in that:

gas which is transmissive with respect to the exposure beam is independently supplied to the optical paths which are each substantially sealed; and

temperature-controlled gas is supplied to the vicinity of the mask, substantially in parallel with a pattern formation face of the mask.

9. An exposure apparatus, having an exposure light source which generates an exposure beam and an exposure main unit which holds a mask and substrate, and in which the exposure beam is used to transfer a pattern of the mask onto the substrate; the exposure apparatus being characterized by further comprising:

a first illumination system, supported independently from the exposure main unit, which transmits the exposure beam from the exposure light source; and

a second illumination system, fixed to the exposure main unit, which guides the exposure beam emitted from the first illumination system to the exposure main unit.

10. The exposure apparatus according to claim 9, characterized in that the optical paths of the exposure beam within the first illumination system and the second illumination system are each substantially sealed, and gas transmissive with respect to the exposure beam is independently supplied to the sealed first and second optical paths.

11. The exposure apparatus according to claim 9 or claim 10, characterized in that a plane of incidence of the exposure beam emitted from the first illumination system on the second illumination system is conjugate with respect to the pattern formation face of the mask, and that a field stop is positioned in the incidence plane.

12. An exposure apparatus, comprising a projection optical system which projects an image of a pattern of a mask onto a substrate, and a substrate stage which holds the substrate and positions the substrate in both first and second directions, which intersect each other; the exposure apparatus being characterized by further comprising:

a first interferometer and a second interferometer, which respectively detect the positions in the first and second directions of the substrate stage; and,

a temperature-control device, having first, second, and third blower outlets to supply temperature-controlled gas to an optical path of the measurement beam of the first interferometer, to an optical path of the measurement beam of the second interferometer, and onto the substrate, respectively.

13. The exposure apparatus according to claim 12, characterized in that:

the first interferometer and the second interferometer each have a reference mirror, installed on the projection optical system and irradiated by a reference beam; and,

the third blower outlet of the temperature control device is formed in an extended end part of a cover member to supply temperature-controlled gas to the reference beams.

14. An exposure apparatus for transfer of the image of the pattern of a mask onto a substrate via a projection optical system, characterized by comprising:

a cylindrical retaining member which covers sides of the projection optical system, and

a temperature control device which supplies temperature-controlled gas from an aperture provided in part of the retaining member, through a space between the sides of the projection optical system and the retaining member, onto the substrate.

15. The exposure apparatus according to claim 14, characterized in that coolant to cool the projection optical system is supplied to the inside of the retaining member.

16. A method of manufacture of an exposure apparatus, characterized by assembling, in a prescribed positional relation:

a projection optical system which projects an image of a pattern of a mask onto a substrate;

a substrate stage which positions the substrate within a plane substantially perpendicular to an optical axis of the projection optical system;

a focusing stage which drives at least one of the mask and the substrate in a direction of the optical axis of the projection optical system;

a first focus position detection system which, by illuminating with a beam for detection, obliquely with respect to the optical axis of the projection optical system, a first set of a plurality of measurement points on a surface for detection on an object plane side and on an

image plane side of the projection optical system, individually detects focus positions which are positioned in the optical axis direction of the plurality of measurement points; and,

a second focus position detection system which, by illuminating with a beam for detection, obliquely with respect to the optical axis, a second set of a plurality of measurement points on the surface for detection, at least some of which are substantially common with the first set of plurality of measurement points, individually detects focus positions at the plurality of measurement points.

17. A method for manufacture of an exposure apparatus, characterized by assembling, in a prescribed positional relation:

an exposure light source which generates an exposure beam;

an exposure main unit which holds a mask and substrate;

a first illumination system, supported independently from the exposure main unit, which transmits the exposure beam from the exposure light source; and,

a second illumination system, fixed to the exposure main unit, which guides the exposure beam emitted from the first illumination system to the exposure main unit.

18. A method of manufacture of an exposure apparatus, characterized by assembling, in a prescribed positional relation:

a projection optical system which projects an image of a pattern of a mask onto a substrate;

a substrate stage which holds the substrate, and which positions the substrate in each of first and second directions, which intersect each other;

a first interferometer and a second interferometer, which detect the positions in the first and second directions respectively of the substrate stage; and,

a temperature control device, having first, second and third blower outlets to supply temperature-controlled gas to an optical path of a measurement beam of the first interferometer, an optical path of a measurement beam of the second interferometer, and onto the substrate, respectively.

19. A method of manufacture of an exposure apparatus to transfer the image of the pattern of a mask onto a substrate via a projection optical system, characterized by assembling, in a prescribed positional relation:

a cylindrical retaining member covering sides of the projection optical system, and

a temperature control device which supplies, from an aperture provided in part of the retaining member, temperature-controlled gas which passes through a space

between the sides of the projection optical system and the retaining member onto the substrate.

20. A device manufacture method, characterized by comprising a process for transfer of the pattern of the mask onto the substrate using the exposure method according to any one of claims 1 to 3, 7 and 8.

21. An exposure method in which a mask is illuminated by an exposure beam, and a substrate is exposed to the exposure beam via a projection optical system, characterized by comprising:

illuminating, with a first beam, a plurality of measurement points on a surface for detection on at least one of an object plane side and an image plane side of the projection optical system;

illuminating, with a second beam, measurement points, at least one of which is set at substantially the same position as at least one of the plurality of measurement points; and

detecting position information for the substrate in a prescribed direction along the optical axis of the projection optical system at the at least one of the measurement points by using the first and second beams.

22. An exposure apparatus, in which a mask is illuminated by an exposure beam, and a substrate is exposed to the exposure beam via a projection optical system, characterized by comprising a position detection system in

which a first beam illuminates a plurality of measurement points on a surface for detection on at least one of an object plane side and an image plane side of the projection optical system, while a second beam illuminates measurement points, at least one of which is set in substantially the same position as the plurality of measurement points on the surface for detection, and the first and second beams are used to detect position information for the substrate in a prescribed direction along an optical axis of the projection optical system at the at least one of the measurement points.

23. The exposure apparatus according to claim 22, characterized in that the position detection system irradiates the first and second beams obliquely with respect to the optical axis of the projection optical system and with respect to the surface for detection, and from mutually different directions.

24. The exposure apparatus according to claim 22 or claim 23, characterized in that the position detection system sets some or all of the at least one of the measurement points within a prescribed area on the surface for detection, illuminated by the illumination light.

25. The exposure apparatus according to claim 22 or claim 23, characterized in that the position detection system illuminates, with the second beam, a plurality of measurement points which include the at least one of the

measurement points; and the exposure apparatus further comprising an adjustment device which, based on the position information for the substrate detected using the illumination of at least one of the first and second beams, moves the image plane of the projection optical system relative to the substrate.

26. A device manufacture method, characterized by comprising a process to transfer the pattern of a mask onto a substrate by using the exposure apparatus of any one of claims 22 to 25.